Information Needed for LAr20 ODH Assessment

An ODH assessment takes into account those factors that could create an oxygen deficiency hazard. The factors include, equipment failure, piping failure, human error, safety equipment failure and ventilation failure. For each failure event, a release rate of fluid is estimated. The fluid release rate combined with knowledge of the affected volume (size and ventilation) is used to calculate the resulting minimum oxygen concentration and likelihood that the event will result in a fatality. For a given volume, the event fatality rates are summed, and the ODH classification is assigned.

The inputs needed to perform an ODH assessment are:

- Volume and ventilation of the area to be analyzed,
- Enumeration of components in the space that have the potential for release of fluid,
- Failure rate for the components,
- A means to estimate fluid release rate.

Failure rates (probability of failure or reliability) are used to quantify the risks from equipment and components. Published failure rate data is available for typical or frequently used equipment and components. Unique applications and special equipment failure rates have to be determined from historical data, experience or estimated.

Failure rates data can be in the form of failures per unit time or number of failures per a defined period of time, such as "per 10^6 hours". Time units can be hours, days, months, or years.

The input needed to perform an ODH assessment for LAr20 is detailed below.

CAVERN AIR SPACE

This is the air volume that could be affected by a cryogen or gas leak.

- Cavern air space dimensions. This is used to calculate the affected volume. A sketch or drawing is preferred. For a simple rectangular room, this would be width, length and ceiling height. Simplification of complex space shapes is acceptable as long as the simplification under-estimates the air volume.
- Cavern air space location relative to grade (ground level).

VENTILATION

Ventilation of interest for an ODH is any ventilation existing or planned that brings in fresh air or exhaust cavern space air.

- Type of ventilation
- Operation - continuous, intermittent, schedule, manual, other
- Location of air supply and return vents relative to floor
- Capacity
    - For air movers in parallel
        - Air mover source – cavern air or outside air
        - CFM capacity per air mover
    - For air movers in series
        - Series air mover source – cavern air or outside air
        - CFM capacity – for train of air movers
        - Reduced CFM capacity – one air mover turned off or failed
- Backup power?
    - Type
    - Failure rate and basis

PROCESS DATA

Indicate any cryogens or gases, other than argon and nitrogen, which would or could be used. Other cryogens and gases include cryogen or gas mixtures.

- List of cryogens and/or gases stored indoors
- List of cryogens and/or gases stored outdoors

PROCESS EQUIPMENT DATA

Process equipment data should be grouped as systems; membrane tank system, nitrogen system (if used), argon circulation/filtration system, filter regen system, and argon filling/emptying system. Within those groupings, the following information will be needed.

- Metal, storage and pressure vessels – tanks, filters, dewars, etc
    - For each type and size
        - Number of vessels of this type and size
        - List of Cryogens or gases contained
        - Max inventory of cryogen and/or gas
        - Operating pressure range
        - Elevation relative to floor (people space)

        - Indoors or outdoors?
        - If indoors, indicate number of relief valves that can vent inside cavern (not hard piped outside directly or through shared vent)
- Non-rigid or non-metal, storage tank or pressure vessels (membrane tank)
    - For each type and size
        - Dimensions
        - Max inventory of argon
        - Operating pressure range
        - Tank drawing
        - Elevation relative to floor (people space).
        - Failure rates for
            - Pin-hole leak, failure rate and size range
              For example: failure (risk) rate a 0.01 mm^2 leak occurs.
            - Small leak, failure rate and size range
              For example: failure rate a 0.01 mm^2 to 10 mm^2 leak occurs.
            - Large leak, failure rate and size range
              For example: failure rate a 10 mm^2 to 1000 mm^2 leak occurs.
            - Catastrophic failure, failure rate
              For example: failure rate a leak larger than 1000 mm^2 occurs.
        - Failure rates for leak rates can be used. If this data is provide in place of failure rates for a size range then also provide information on how the leak rate is determined.
        - Indicate number of relief valves that can vent inside cavern (not hard piped outside directly or through shared vent)

- Supply vessels (dewars, gas bottles, cryogen trailers, gas trailer, etc)
    - For each type of supply vessel containing the same cryogen or gas
        - Number of supply vessels of this type and size
        - Max inventory of cryogen or gas
        - Max supply pressure
        - Elevation relative to floor
        - Location - indoors or outdoors?
- Rotating Equipment
    - Cryogen pumps
        - For each type and size, sharing the same source (supply)
        - Number of pumps of this type and size
        - Source (supply)
        - Max operating pressure
    - Cryogen or gas compressors
        - For each type and size, sharing the same source (supply)
        - Number of compressor of this type and size
        - Source (supply)
        - Max operating pressure

PIPING

- Liquid Piping
    - For each size, containing the same cryogen, with the same max operating pressure
        - Total length
        - Number of flanges
        - Number of hard piped valves
    - Number of drains or vents without hard-piped destinations. Include description of why and how frequently the drain or vent would be operated.
    - Number of relief valves that can vent inside (not hard piped outside directly or through shared vent pipe)
    - Identify limited time use piping separately – such as piping for initial filling or emptying.

- Vapor or Vent Piping
    - For each size, containing the same cryogen, with the same max operating pressure
        - Total length
        - Number of flanges
        - Number of hard piped valves
    - Number of drains or vents without hard-piped destinations. Include description of why and how frequently the drain or vent would be operated.
    - Number of relief valves that can vent inside (not hard piped outside directly or through shared vent pipe)
- Filter Regen Cryogen or Gas Piping
    - For each size, containing the same cryogen, with the same max operating pressure
        - Total length
        - Number of flanges
        - Number of hard piped valves
        - Number of drains or vents without hard-piped destinations. Include description of why and how frequently the drain or vent would be operated.
        - Number of relief valves that can vent inside (not hard piped outside directly or through shared vent pipe)

OTHER HAZARDS

- List any special hazards to the cryogen/gas equipment or piping.
    - Forklifts used in vicinity
        - Proximity
        - Frequency of use
    - Overhead cranes used in vicinity
        - Proximity
        - Frequency of use
    - Other credible hazards that could result in a cryogen or gas release within the affected area
        - Seismic?
        - Flooding?